AMENDMENT NO. 2 APRIL 2022

TO

IS 7098 (PART 2) : 2011 CROSSLINKED POLYETHYLENE INSULATED THERMOPLASTIC SHEATHED CABLES — SPECIFICATION

PART 2 FOR WORKING VOLTAGES FROM 3.3 kV UPTO AND INCLUDING 33 kV

(Second Revision)

[*Page* 1, *clause* **1.1**(b)(2)] — Substitute '*Unearthed systems* : 3.3/3.3 kV, 11/11 kV and 33/33 kV' *for* '*Unearthed system*: 3.3/3.3 kV and 11/11 kV'.

(*Page* 1, *clause* **2**) — Insert the following text at the end of the clause:

IS No.	*Title*
13360 (Part 6/Sec 9)	Determination of density of smoke from the burning or decomposition of plastics

(*Page* 2, *clause* **3.2**, *Note*) — Substitute the following for the existing Note:

NOTES:

1 These tests are of such a nature that after they have been made, they need not be repeated unless changes are made in the cable materials or design which might change the performance characteristics.

2 When type tests have been successfully performed on a type of cable covered by this standard with a specific conductor cross sectional area and rated voltage, type approval shall be accepted as valid for cables of same type with other conductor cross-sectional areas and/or rated voltage provided the following three conditions are all satisfied:

a) The same material, that is, insulation and semi-conducting screens, and manufacturing process are used.

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b) The conductor cross-sectional area is not higher than that of the tested cable, with the exception that all cross- sectional areas up to and including 630 mm^2 are approved when the cross-sectional area of previously tested cable is in the range of 95 mm^2 to 630 mm^2.

c) The rated voltage is not higher than that of the tested cable. Approval shall be independent of the conductor material.'

(*Page* 4, *Table* 4, *col* 9) — Insert the following new column (10)

33/33kV mm (10)
-
-
-
9.0
9.0
9.0
9.0
9.0
9.0
9.0
9.0
9.0
9.0
9.0
9.0

(*Page* 5, *clause* **14.1**) — Substitute '3.8/6.6, 6.35/11, 11/11, 12.7/22 ,19/33 kV and 33/33 kV' *for* '3.8/6.6, 6.35/11,11/11, 12.7/22 and 19/33 kV'.

(*Page* 6, *clause* **17.5**) — Insert the following new clause after **17.5**:

'**17.6** The round steel wires/formed steel wires taken from the cable shall meet the following requirements.

17.6.1 The tensile strength of round steel wire/formed steel wire shall be not less than 250 N/mm^2 and not more 580 N/mm^2.

17.6.2 The elongation at break of round steel wire/formed steel wire shall be not less than 6 percent.

17.6.3 Round steel wire shall meet the requirements of torsion test. The gauge length between vices and the minimum number of turns without break shall be as per Table 6 of IS 3975.

17.6.4 The zinc coating shall not show any cracks and shall not flake off on rubbing by the bare finger when the formed steel wire is subjected to winding test.

17.6.5 The uniformity of zinc coating of round steel wire/formed steel wire shall comply with the requirements of IS 3975 subject to the following:

a) The minimum number of dips shall be reduced by one half-minute dip, and
b) In case of formed wires, dip test is applicable only for the face.

17.6.6 The mass of zinc coating of round steel wire shall not be less than 95 percent of the mass specified in Table 2 of IS 4826.

The mass of zinc coating of formed steel wire shall not be less than 95 percent of the mass specified in IS 3975.

17.6.7 The resistivity of the round steel wire/formed steel wire shall meet the requirements of IS 3975.

[*Page* 6, *Table* 7, *Sl No.*(ii), *col* 5] — Substitute '1.40' *for* '1.4'.

[*Page* 6, *Table* 7, *Sl No.*(vii), *col* 5] — Substitute '2.20' *for* '2.2'.

[*Page* 6, *Table* 7, *Sl No.*(xii), *col* 5] — Substitute '3.00' *for* '3.0'.

[*Page* 6, *Table* 7, *Sl No.*(ii), *col* 6] — Substitute '1.40' *for* '1.4'.

[*Page* 6, *Table* 7, *Sl No.*(vii), *col* 6] — Substitute '2.20' *for* '2.2'.

[*Page* 6, *Table* 7, *Sl No.*(xii), *col* 6] — Substitute '3.00' *for* '3.0'.

[*Page* 7, *Table*, *Sl No.*(i)] — Substitute the following for the existing:

Sl No.	**Test**	**For Requirements, Ref to**	**Method of Test, Ref to IS 10810**
(1)	(2)	(3)	(4)
i)	Test on conductor:		
	a) Annealing test (for copper)	IS 8130	1
	b) Tensile test (for aluminium) (not applicable for compacted or shaped conductor)	IS 8130	2
	c) Wrapping test (for aluminium)	IS 8130	3
	d) Resistance test	IS 8130	5

[*Page* 7*, clause* **19.1***, Sl No*. (vi) h*, col* 2] **—** Substitute 'Carbon black content of polyethylene sheath **(**applicable for Black PE sheath only**)'** *for* 'Carbon black content of polythene sheath'.

[*Page* 7, c*lause***19.1**, *Sl No*. (xv)] — Insert the following row at the end:

(1)	(2)	(3)	(4)
xvi)	Longitudinal water penetration test	**20.16**	*see* Annex G'

(*Page* 8, *clause* **19.1.2.1**) — Insert the following new clause **19.1.2.2** after clause **19.1.2.1**:

'**19.1.2.2** Following tests may be carried out on a different sample from the sample used for the normal sequence of tests listed in **19.1.2**

a) Measurement of dielectric power factor as a function of voltage.

b) Voltage test for 4 h, preceded by:

    1) bending test followed by partial discharge test [*see***19.1.2** b)]; and

2) heating cycle test followed by dielectric power factor as a function of voltage and partial discharge test [*see***19.1.2** e)]'.

(*Page* 8, c*lause* **19.1.3**) — Insert the following new sentence at the end:

'These tests are applicable for PVC sheathed cables with improved fire performance only.'

[*Page* 8, *Table under* **19.1.3**, Category C2, (d), *col* 4] **—** Substitute '*See* **20.14**' *for* 'under preparation'**.**

(*Page* 8, c*lause* **19.2**, **19.2.1**, **19.2.2**) — Substitute the following for the existing clauses:

19.2 Acceptance Tests

The following shall constitute acceptance tests:

a) Conductor resistance tests,
b) Test for eccentricity of insulation and thickness of insulation and sheath,
c) Hot set test for insulation,
d) Tensile strength and elongation at break test for insulation and outer sheath,
e) Partial discharge test (for screened cables only),
f) High voltage test,
g) Insulation resistance (volume resistivity) test.

NOTE — Partial discharge test shall be carried out on full drum length.

19.2.1 The following shall constitute additional acceptance tests for cables with improved fire performance as per the categories given in Annex C.

Category	Test
01	No additional test
C1	a) Oxygen index
	b) Flame retardance test on single cable
	c) Flame retardance on bunched cables
C2	a) Oxygen index
	b) Flame retardance test on single cable
	c) Flame retardance test on bunched cables
	d) Test for halogen acid gas evolution
	e) Test for smoke density (on sheathing material)

19.2.2 A recommended sampling plan for acceptance test is given in Annex. D. However, following tests shall be performed on one sample only:

a) High voltage test (as per **20.7.1**, 4 h test),
b) Insulation resistance test,
c) Oxygen index test,
d) Temperature index test,
e) Test for halogen acid gas evolution,
f) Test for smoke density,
g) Flame retardance test on single cable, and
h) Flame retardance test on bunched cables.

(*Page* 9, *clause* **20.2**) — Substitute the following for the existing clause**:**

20.2 Partial Discharge Test

The partial discharge magnitude at test voltages mentioned below shall not exceed 10 pC for Routine Tests/Acceptance tests and 5 pC for Type Tests.

Rated Voltage kV	*Partial Discharge Test Voltage* kV
3.8/6.6	6.6
6.35/11	11
11/11	19
12.7/22	22
19/33	33
33/33	45

(*Page* 9, c*lause* **20.6,** *Rated Voltage and Impulse Voltage*) **—** Substitute for the following for the existing:

Rated voltage, kV	3.8/6.6	6.35/11	11/11	12.7/22	19/33	33/33
Impulse voltage, kV	60	75	95	125	170	250

(*Page* 9, *Clause* **20.6**) — Title to be read as '**Impulse Withstand Test followed by a Voltage Test**' *for* '**Impulse Withstand Test**'.

(*Page* 9, *Clause* **20.6**) — Insert the following new clause **20.6.1** after clause **20.6**:

'**20.6.1** After the impulse test, the sample shall withstand without failure the test voltage given in **20.7.2** for a period of 15 min. for each test connection.'

(*Page* 9, *clause* **20.7.1**, *para* 1) — Substitute the following for the existing para:

The cable shall withstand without breakdown an a.c. voltage for 4 h as per table below when applied to the sample between conductor and screen/metallic tape/ armour (and between conductors in case of unscreened cable). The voltage shall be increased gradually to the specified value:

Voltage Grade kV	*Test Voltage Between Conductor and Screen/Armour (and Between Conductor in Case of Unscreened Cable)* kV
1.9/3.3 and 3.3/3.3	10
3.8/6.6	15.5
6.35/11	25.4
11/11	44
12.7/22	51
19/33	76
33/33	99

(*Page* 9, *clause* **20.7.2**) — Substitute the following for the existing clause:

20.7.2 Routine Test — The cable shall withstand without any failure the test voltage as per table below, when applied for a period of 5 min for each test connection.

Voltage Grade kV	*Between conductor* kV (rms)	*Test Voltage Between Conductor and Screen/Armour* kV (rms)
1.9/3.3 and 3.3/3.3	10	10
3.8/6.6	–	13
6.35/11	–	21
11/11	–	35
12.7/2	–	42
19/33	–	63
33/33	–	84

(*Page* 10, *clause* **20.14**) — Substitute 'The test shall be conducted as per IS 13360 (Part 6/Sec 9) : 2001 Determination of density of smoke from the burning or decomposition of plastics. Smoke density rating shall be 60 percent max.' for the existing text.

(*Page* 10, c*lause* **20.15**) — Insert the following new clause at the end:

'20.16 Longitudinal Water Penetration Test (for Cables with Water Tight Construction as Agreed between the purchaser and the supplier)

Test shall be carried out as per Annex G. During the period of testing no water shall emerge from the ends of the test piece.

NOTE — For three core cables, test is applicable on cores removed from the cable after bending test.'

[*Page* 14, Annex F (*see also* Amendment No. 1)] — Insert the following new Annex G at the end.

‘ANNEX G

(*Clause* 20.16)

METHOD FOR TEST FOR LONGITUDINAL WATER PENETRATION

G-1 GENERAL

This test is intended to be applicable to cables which are designed and constructed to meet the requirement of preventing the longitudinal propagation of water along the cable in case of accidental damages to the outer sheath of the cable.

G-2 TEST SAMPLE

|**G-2.1** A sample of a completed cable at least 3 m in length which has not been subjected to any of the tests described in **19.1** shall be subjected to bending test as per **20.3** and placed horizontally. A ring of approximately 50 mm wide shall be removed from the centre of the length. This ring shall comprise of all the layers external to the insulation screen. Where the conductor is claimed to contain a longitudinal water barrier, the ring shall comprise of all the layers external to the conductor.

If the cable contains intermittent barriers to longitudinal water penetration then the sample shall contain at least two of these barriers, the ring being removed from between the barriers. In this case, the average distance between the barriers in such cables should be stated and length of the cable sample shall be determined accordingly.

The surfaces shall be cut so that the interfaces intended to be longitudinally watertight shall be readily exposed to the water. The interfaces not intended to be longitudinally watertight shall be sealed with a suitable material or the outer coverings removed.

G-2.2 Suitable arrangements shall be made as in Fig. 2 to allow a tube having a diameter of at least 10 mm to be placed vertically over the exposed ring and sealed to the surface of the outer sheath. The seals where the cable exits the apparatus shall not exert mechanical stress on the cable.

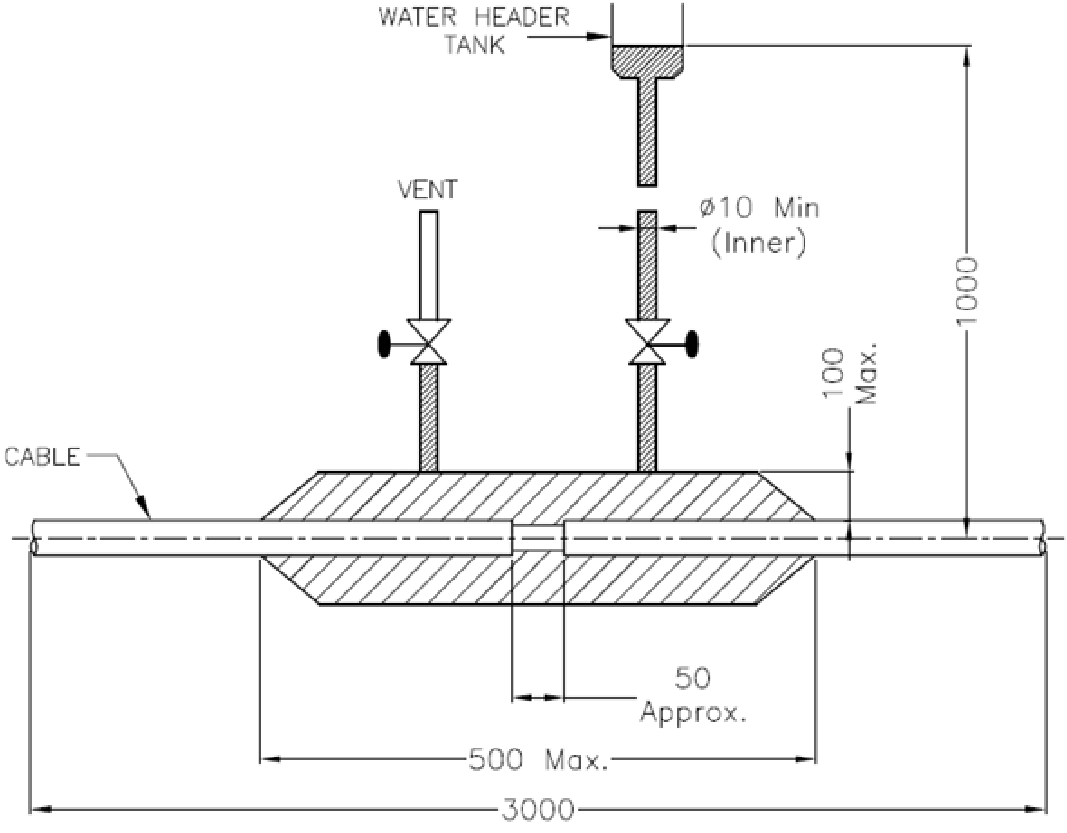

FIG. 2 SCHEMATIC DIAGRAM FOR APPARATUS FOR LONGITUDINAL WATER PENETRATION TEST

(All dimensions in millimeters)

G-3 TEST PROCEDURE

The tube shall be filled with normal tap water at ambient temperature so that the height of the water in the tube is 1 m above the cable centre. The sample shall be allowed to stand for a period of 24 h.

The cable shall then be subjected to 10 heating cycles by passing current through the conductor, until the conductor reaches a steady temperature of 5°C to 10°C above the maximum conductor temperature in normal condition.

The duration of heating cycle shall be at least 8 h. The conductor temperature shall be maintained within the stated temperature limits for at least 2 h of each heating period. This shall be followed by at least 3 h natural cooling.

The water head shall be maintained at 1 m.’

(ETD 09)

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